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ANNUAL REPORT

OF THE

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

FOR THE CALENDAR YEAR 1945

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Forest Service
U. S. Department of Agriculture

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INTRODUCTION

In common with the rest of the world the Pacific Northwest Forest and Range Experiment Station found 1945 a year of transition from war to peace. The shift in the case of this Station was complicated by a change in the directorship and by considerable change in personnel and program. The end of the war has not meant the end of all war-born activity, but the conversion to the long-range peacetime point of view is taking place and will guide all program planning in the immediate future.

Mr. Wyckoff left the Station the first of April. Mr. Hall, the incoming Director, was unable to assume his duties until July 1. His necessary absence in Washington in connection with the completion of the alcohol plant at Springfield, Oregon, has prevented as much acquaintance with the fundamental problems of the region and the program of the Station as it had been hoped to accomplish. This general report must, therefore, be regarded as representing those broad views obtainable in limited time and with a very limited opportunity to carry on the necessary field surveys without which no adequate knowledge of the forestry problems of a region can be obtained.

Even with these limitations there are some things that seem clear in the Pacific Northwest.

The process of harvesting accessible old-growth timber was merely accelerated by the war and the inevitable exhaustion of easily logged old-growth stands brought closer. This was probably inescapable because with the drastic shortages of manpower and equipment that were felt so keenly during the war, lumber production could hardly have been maintained as well as it was without the availability of some accessible reserves.

With the end of the war the lack of easily available high-grade logs is forcing the industry to analyze its position carefully. The formerly extensive, open log market maintained in Puget Sound and the Columbia River may be said to have passed out of existence. Numerous plants have had to close, including two large sawmills in Portland. Numerous others in the region will expire within a few years. New capacity probably equals the abandoned capacity, but a rapid migration is taking place.

The remaining extensive privately owned virgin stands in the Douglas-fir region are in southwestern Oregon and the largest development of new milling capacity is taking place in that region. It may be expected that, unless unforeseen circumstances prevent it, the history of southwestern Oregon will merely repeat the history of the older logged sections of the region. There is, however, a definitely discernible will on the part of the leaders of thought in southwestern Oregon to prevent the disasters that follow upon timber exhaustion, but they lack the tools with which to bring about the control that needs to be effected. It is difficult to see how the too-rapid liquidation of the timber of western Oregon can be prevented on private lands without imposition of public cutting controls, little basis for which exists in Oregon law at the present time.

The recently enacted timber conservation acts of Oregon and Washington have little to do with rates of liquidation of old-growth timber and very little to do with the maintenance of growing stock. They are both aimed primarily at the insuring of adequate regeneration and neither appears to be particularly satisfactory even from this limited point of view.

There is region-wide interest and discussion of "sustained yield forestry" but as has been the case with other popularized slogans such as "selective cutting" the definition of sustained yield is as wide as the interests of those who propose to practice it. Thus far there has been little incorporating in the concept of anything having to do with quality and species of material grown, little attention to accessibility of stands, and little recognition of the fundamental concept of maximum productivity within a definite time limit. Proposed public-private cooperative sustained yield units are being submitted to critical review and questioning on the part of numerous individuals and agencies. On the one hand, certain private interests are not content to make long-term commitments of cutting policies in order to obtain cutting rights on public lands. On the other hand, some quasi-public agencies and private interests feel that some proposed sustained yield operations give too much from government in return for too little from private industry and that in some cases the establishment of cooperative sustained yield units means merely the perpetuation of monopolistic tendencies in ownership already firmly established.

Unquestionably, public interest in forest management and utilization is high, but the characteristics of the future industry are not clear. There has been and continues to be a tendency to block holdings into very large ownerships. If the present tendency in accumulation of holdings continues the entire forest industry of the Northwest within a comparatively few years will be dominated by not more than a half dozen companies. There has been a mad scramble for cutovers and second growth, and prices have been paid that would formerly have been considered exorbitant. Quite often high prices have been paid for "controlling" properties. It is too early to determine whether this movement is the temporary result of extraordinarily high commodity prices or the operating of a will toward permanent sustained yield forest management.

The "Tree Farm" movement has moved steadily forward and, limited as it may be in its conception, still has the undoubted advantage of the dedication of large tracts of land to permanent forests. The concept thus far falls far short of intensive management but it is to be hoped that intensive management will follow as it becomes apparent that it is profitable.

It is clear that the future of relatively small forest holdings in this region is clouded with uncertainty. There is a wide range of opinion as to the economic soundness of this or that sized operation. Some men argue firmly that only the very large operation can grow timber, harvest it, and manufacture it efficiently. At the opposite extreme is a body of opinion holding that a highly efficient operation can be maintained on as little as a township of high site quality land. Furthermore, there is a strong movement toward the development of centralized remanufacturing plants drawing their raw material from widely dispersed, small sawmills. There is also a developing tendency to do a great deal of log trading between operations, that is, the trading of peeler logs, for example, for sawlogs, or of pulp logs for peeler logs, etc. The formerly widespread tendency to raid individual stands for a single product is gradually giving way to the conception of diversified utilization, but diversified utilization is still in an embryonic state.

The uncertainties involved in this question of economic size of operating units merely accentuates the necessity for some thoroughgoing economic research in the region that has not been done.

It cannot be denied that intensive forest management is coming rapidly in this region but only the faintest patterns of its nature are emerging. It is not likely to be invoked early except on lands of high growth capacity, and most of the virgin stands on such land of high accessibility have already been harvested. Therefore, early intensive management will probably be instituted on second growth on highly productive and accessible sites. Currently, operations on too many of such stands are taking the form of ill-advised, premature harvesting and very poor utilization. This is true whether the primary product is poles, piling, crossties, or pulp. There is strong possibility of integrating the production of all such forms of wood with the long-range production of high-grade saw timber and peeler logs, but very little has been done to bring about such a form of management. The pressure upon second growth by the economic need for material and jobs in the older parts of the region makes it highly advisable that as rapid progress as possible be made toward the laying of research foundations and demonstration of second-growth, intensive management.

Intensive management on high-quality sites can only take place under intensive protection. Only intensive management can repay the costs of intensive protection. Intensive protection will be extremely difficult and expensive unless accompanied by close utilization in the woods.

There is increasing tendency toward close utilization. One large company is removing logs to a 6-inch top from some of its lands. A second large

company is relogging to an 8-inch top. These are isolated instances, but since the two companies involved are large and powerful it may be expected that their example will be followed by others. Thus far, however, the facilities for diversified utilization are too limited to afford the kind of opportunity for thorough cleanup that is required. Close utilization of the forest crop should bring about greatly reduced costs of protection, should accelerate regeneration and growth, and give greatly reduced costs in the growth of stands.

One of the weakest points in connection with the usual "sustained yield" statement is the tendency to argue that the exhaustion of old growth is of no consequence, that the production of quality material is unimportant, and that the demands for timber in the future will be such that cubic volume of any species in the Northwest is of paramount importance. It seems improbable that this will be the case. The Northwest is from two to three thousand miles from its principal lumber markets. The major burden of its timber business will probably continue to be borne by quality lumber, plywood, and pulp. Those who contend that second growth of doubtful quality will fill the future needs formerly supplied by high-quality lumber from virgin stands usually contend that it is uneconomic to harvest the low-grade material present in the old stands. In the face of the established fact that most second-growth fir, especially that grown in understocked stands, produces nothing but common lumber, it is difficult to see how its logging and manufacture can become profitable unless there is a virtual revolution in the quality of material demanded by the market. No such revolution is in sight. Other sections of the country can probably supply the common lumber market more economically than can the Pacific Northwest. If the lumber supply from the Northwest degenerates to the point where it is composed almost entirely of common material, it may be expected that wood will lose its predominant position in many fields now occupied by it almost exclusively.

It is difficult to escape the conclusion that much of the thinking along these lines is wishful thinking and that foresters and lumbermen are too much inclined to seek an easy formula under which to practice forestry. This tendency has been aided by a widespread popular conception that in the future trees will be grown merely for the purpose of grinding them up and assembling them into "synthetic boards" or miraculously transforming them into plastics. It cannot be too strongly emphasized that there is nothing in prospect to indicate that such products will be other than the byproducts of the growing and manufacture of good quality lumber, plywood, and pulp.

Under natural growing conditions on most sites the production of clear material requires long rotations and full stocking. The full stocking can be achieved, but on privately owned lands the long rotations may prove to be difficult. It seems quite probable, therefore, that publicly owned lands may be called upon to grow the older, clear material under extensive forms of management. High quality sites may repay such techniques as pruning and thinning for the specific purposes of growing high-

quality material. These are matters that will require the most careful exploration in the future.

Public attention was focused during 1945 upon the reburning of the old Tillamook Burn. There is increasing clamor to "do something about the Tillamook Burn" but comparatively little recognition of the true facts involved. Many suggestions for quick rehabilitation of this devastated area have been discussed in the public prints. None of them have been subjected to experimental demonstration and most of them do not appear practical. Most foresters are in agreement that following the recent reburn, which eliminated most reproduction and destroyed small areas of seed source within the burn, no natural regeneration can be expected during a very long period of years. Planting ought not to be done until the enormous areas of snags have been removed. To do otherwise would be merely to invite a repetition of the disastrous burn of 1945 and a loss of all investments in planting. Cleanup should be planwise and follow a very definite pattern aimed at providing the maximum protection in a minimum of elapsed time. The costs will be high but large returns are possible from properly conducted salvage operations.

Past salvage operations have been almost purely attempts to recover high-grade logs without very much regard for hazard reduction. There has been some removal of fuel, of course, but in toto the salvage logging has not resulted in a very great reduction in hazard level. Such salvage is not the type that should precede planting. The aim should be to remove as nearly as possible all of the old wood. It is believed that with proper integration of veneer mill, sawmill, pulp mill, and chemical utilization a nearly complete cleanup could be accomplished. It is not known what percentages of material in the reburned area could be made available to each of the several types of use. Nor is it known what the costs of collecting, breaking down, and sorting the material might be. Therefore, the returns from such salvage that could be set off against the total costs of preparing the land for planting could not be determined.

The Tillamook Burn is merely a large example of considerable territory in the Pacific Northwest with the same characteristics. Nor is it necessarily the last burned area of great magnitude. It is hoped that the Forest Utilization Service in cooperation with Forest Management will be able to work out cooperative arrangements with the State, county, and private authorities so that good-sized experimental operations can be carried out on the Tillamook Burn in order to arrive at firm cost figures for conducting complete salvage and planting operations that will be applicable to all such territory in the Pacific Northwest.

A change in division leadership in Range Management coincided with the initiation of a program of range reseeding. Therefore, a considerable amount of time has been given to the initiation of the new reseeding program and the orientation of new personnel.

Little attention has been given to general problems of erosion control and streamflow. That there are such problems in the region is perfectly apparent and it is hoped that some thought and field discussion can be given to them in the coming year. Perhaps the most pressing need is for a field analysis of the erosion and water problems of the region as they are concerned with forest and range lands, but it is difficult to see how such an analysis can be accomplished with present personnel short of impossible sacrifices in other fields.

More extended reports by Divisions follow.

FOREST ECONOMICS

Forest Survey

During 1945 war projects and service jobs, such as supplying survey maps and statistical information to many individuals and concerns seeking new and secure sources of timber supply, continued to absorb a major amount of time. The Reappraisal Project was another large undertaking of 1945. As a result, the county reinventory program had to be curtailed in field and office.

Statistics of forest-type area and timber volume for the 66 forested counties of Oregon and Washington were made current as of January 1, 1945, through application of calculated growth and drain data to the most recent field inventory results. This information was summarized in several forms for the Reappraisal Project.

Field mapping in the reinventory of Clackamas and Marion Counties, Oregon, was completed and revised and 1-inch-to-the-mile forest type maps were drafted and released. Office compilation of type-area and timber-volume data for Marion County and type-area data for Clackamas County was completed.

In June, field work was started on the reinventory of Klamath County, Oregon, and was about 60 percent completed by the end of field season. In this county, the first to be covered in the ponderosa pine region, cutting has been very heavy during the 11 years since the original inventory; annual cut has averaged close to 600 million board feet, 90 percent ponderosa pine.

In response to a request by the Rural Electrification Administration for information on the number of power transmission poles that could be obtained from lodgepole pine stands in Oregon and Washington, field sampling of stands in central Oregon was started. Although storms and deep snow limited the field work, analysis of the samples obtained indicate there is a considerable acreage of lodgepole in the region that would be operable for REA poles.

"Forest Statistics for Linn County, Oregon," which gave results of the reinventory of this heavily timbered county, was released and received a very good response from private and public agencies. An original edition of 500 copies proved insufficient. Linn County, which has a total timber volume of 26.8 billion board feet, 14.1 billion feet of which is privately owned, is being cut over at a greatly accelerated rate. Currently, sawlog production is nearly three-quarters of a billion board feet a year; during the thirties it was as little as 45 million feet a year. About one-third of the sawlogs produced in the county are manufactured into lumber in Linn County mills, the remaining logs going to mills in other parts of western Oregon and western Washington. The current annual drain is more than twice the annual allowable cut under a sustained yield program. Under war pressure overcutting is permissible but the cut must soon be reconciled with sustained yield capacity if Linn County is to support, permanently, forest industries at an optimum level.

At the beginning of 1946 the major activities most urgently needing attention by the Forest Survey are: (1) The acceleration of the reinventory so that current and accurate resource data may be available to meet principal needs, and (2) the resumption of the comprehensive analyses of the forest situation in critical areas. During the war years the reinventory program fell far behind a satisfactory schedule. Specifically, reinventories should be made for the first time in six counties of the Douglas-fir region. The two island counties, San Juan and Island, may be deferred. Four or five counties of the Douglas-fir region which were the first to be reinventoried (1937 to 1939) should be covered again during the next year or two. The reinventory program in the pine region has barely started. In addition to Klamath County, Lake and Deschutes in Oregon and Kittitas and Chelan in Washington are in need of immediate attention. A corollary problem is the study of possible new field techniques including the application of the expanding knowledge of aerial photogrammetry to forest conditions in this region.

In the field of analysis and interpretation the renewal of the unit analyses similar to that made for the Grays Harbor Unit in 1942 and 1943 and published in 1944 should be directed towards "run-away" economic situations. The Willamette River district is a case in point. Here depletion and industrial activity is increasing rapidly, probably too much so for the good of the resource. Diverse elements are at work. The situation is not beyond repair, however, and a carefully conducted and thorough analysis should point the way for orderly development. Next in order of importance for analytical studies are the Puget Sound and Klamath Plateau districts. Excessive drain in these districts has created forest problems not only of local but of regional and national significance which demand study and solution.

Bonneville Cooperative Survey

This study was initiated at the request of the Bonneville Power Administration and a memorandum of understanding executed May 8, 1945, provides

that the study shall continue through fiscal years 1946 and 1947. An annual sum of $15,000 is allotted to the Station for the study. It consists of a comprehensive study of the forest industries, their raw material base and trends of future development, and the relationships between such developments and power markets in the Columbia Basin. Although the study is under the leadership of this Station, the Northern Rocky Mountain Station is cooperating and furnishing data for Region 1. R. W. Marquis, formerly of the Division of Forest Economics, Washington Office, is heading the project. A working plan has been prepared and reviewed, and preliminary conferences have been held with the Bonneville staff, Regional Office, and Northern Rocky Mountain Station. Memorandum progress reports have been prepared for the plywood and wood pulp industries with particular reference to raw material supply. A substantial beginning has been made on assembling and summarizing resource data, using Forest Survey and Reappraisal material.

Fire Economics

Production of a manuscript report, "Economic Study of Forest Fire Control in Snohomish Area, Washington," was the principal accomplishment of the first six months of this period. The first draft of this report was rewritten after a thorough review at the Station and in the Regional Office. The revised manuscript was submitted to the Washington Office for review. This report recorded the findings of the analysis of the first sample area in Washington or Oregon. It dealt with the monetary and non-monetary costs and damages, with the finances of fire control in the sample area, and stated principles to be applied in determining justifiable expenditures for forest fire control in the Snohomish Area or other areas with similar conditions. The analysis and the report covered both the State and association and national forest fire control districts of the sample area.

The report on the Snohomish area was read by Mr. McArdle during his visit to the region in July. The project was the subject of several conferences. It was indicated that the first study had covered its field acceptably but changes were suggested relative to future work. It was pointed out that because the project was financed from Clarke-McNary section 2 funds, it should be directed toward the production of results of immediate application to the Clarke-McNary program of the region. More specifically, it should be closely related to the current job of revising the cost of adequate protection estimates. Therefore, analysis of national forest fire control units should not be involved in the program. It was also indicated that there should be no emphasis upon the production of reports for general consumption and more emphasis upon the production of results for the immediate use of local Clarke-McNary administrators.

The project was immediately reorganized to meet these specifications. First of all it was decided that analyses should be used of several representative sample areas in Washington and Oregon. The Yakima area in Kittitas and Yakima Counties in Washington had already been selected for study and field work was completed there first. This is an important area in the east side of the Cascades where water from forest lands has

a high value for irrigation and where other factors affecting the justification of fire control expenditures were expected to differ from conditions in the Snohomish area. Four sample areas, Linn, Douglas, Coos-Curry, and Southwest Oregon (Jackson and Josephine Counties), were selected for study in Oregon. The first three are association districts and the fourth is under the direct administration of the State. Field examination of fire damage and some of the compilations have been completed for these sample areas. An analysis of the Clark and Skamania Counties unit in Washington has been started. It is planned to complete analyses of the seven sample areas mentioned above early in 1946 so they can be used in the revision of the cost of adequate protection.

A study of the salvage possibilities on the Tillamook Burn was a side line during the early part of the year. Sample plots were measured to determine the amount of sound wood remaining after salvage operations. An office report was written. It was found that considerable quantities of timber killed in 1933 were actually being salvaged in current logging operations and that huge quantities of salable wood remained in the burn. This year's reburn has, undoubtedly, decreased the amount of sound "waste" wood remaining after logging, thereby making that part of the study obsolete but it probably had little effect upon the amount of salable wood in standing trees.

Requirements, Products, and Supplies

Reports on factors affecting lumber production, which were made quarterly during the first half of 1945 and semi-monthly after September 1, showed that manpower was by far the most important factor adversely affecting lumber production in 1945. This was evidenced by progressive shrinkage in total numbers employed, loss of experienced personnel, and inexperience and inadaptability of classes of labor available until September, and by the industry-wide AFL strike beginning September 24 but unsettled in the fir region until the end of November and still unsettled in the pine region at year's end. The next most important factor was deficiency in manufacturing facilities. The combination of these two factors seriously impaired ability to meet demands for military purposes during the war and for civilian purposes thereafter. It is estimated that 1945 lumber production will have been less than 1944 by about 25 percent in the fir region and 19 percent in the pine.

Complementary to factors reports, military withdrawals, employment of women and output per man-hour were subjected to special study. Military withdrawals were not large in percent of total employed in any one month. They averaged about one-half of 1 percent in pine and less in fir. But they hurt because most of the men taken were experienced and many occupied key positions. Of the total work force, women comprised about 4½ percent in the fir region and 11 percent in the pine. Of the work force in woods and sawmill operations they comprised very small percents but in remanufacturing operations in connection with sawmills they comprised about 20 percent in fir and 25 percent in pine. In the fir region a few large,

modern mills employed a large proportion of the total number of women engaged in manufacturing. These mills are highly mechanized and departmentalized. Among sample fir operations, output per man-hour in 1944-45 ranged from 50 to 100 percent of prewar figures in the woods and ranged from 66 to 125 percent in the sawmills. Among sample pine operations, output per man-hour ranged from 57 to 123 percent of prewar figures in the woods and ranged 71 to 101 percent in the sawmills. Causes contributing to changes in output per man-hour were discussed at length in the factors report for the second quarter.

Monthly reports on log inventories in the three primary log markets--Puget Sound, Columbia River, and Grays Harbor--showed trends in reserve supplies. They gained ground between September 1 and December 1 due mainly to continued woods operations while mills were struck. But as of December 1, 1945, reserves were 25 percent below the 1939-42 average and 10 percent below 1944. Log inventories were also taken for the entire fir region on March 1, June 1, September 1, and December 1, and for the pine region on March 1. Compared to 1944, inventories in the fir region were about 1½ percent less on December 1, 1945, but indicated a strengthening position between September 1 and December 1, 1945.

Monthly reports of production and shipments of aircraft lumber were made for Sitka spruce, noble fir, Douglas-fir and western hemlock for the first eight months of 1945. Each report was accompanied by a brief analysis by Lodewick of the problems the various producers were meeting in maintaining the volume of this type of business.

Census of lumber, lath, and shingles was conducted for 1944 in the usual manner.

Estimates of gross lumber stocks at mills were prepared monthly throughout 1945. The general trend during the year has been downward. Starting with 403 million feet as of January 31, estimates show an over-all decrease of about 100 million feet on December 31. Stocks during the first four months were more or less stable, then dropped rapidly each month till the end of the year.

A survey was made of the pole and piling situation with special emphasis on production prospects during 1945. It was estimated that 1945 pole production would be 20 percent below 1944, and that piling production would be 35 percent greater. Both pole and piling inventories in April 1945 were below those of April 1944. In general, 85 to 90 percent of both poles and piling are subject to some form of preservative treatment.

The fuel wood situation in Oregon and Washington was investigated to determine production and requirements in 1945. The survey indicated a shortage of about 400,000 cords, with requirements estimated as 4,400,000 cords and production 4,000,000 cords. About 89 percent of the production is supplied from mill waste, 9 percent forest wood, and 2 percent other. The most feasible means of supplying the deficit in production is the salvaging of sawmill waste now destroyed.

A region-wide survey and report was made of sawmill waste developed and disposed of in 1944. An estimated 680 million cubic feet of solid wood "waste," bark excluded, was developed. Of this amount, sawmills used for power purposes approximately 40½ percent, sold as fuel 38½ percent, sold for manufacture into pulp, lath, pickets, etc., 2½ percent, and destroyed 18½ percent. The report furnished estimates of fine and coarse waste developed and disposal of the same in the western and eastern parts of Washington and Oregon.

A survey was made and reported of log-truck tire needs in all but five Washington counties and in northeastern Oregon. This furnished estimates of tires required for down units and for replacement in March and April. Two special studies of log-truck tire requirements were made and reported, one covering a Willamette Valley fir operation and the other a central Oregon pine operation. They showed the number of log trucks in the fleet, the number of log trucks laid up for want of tires, number of tires in use, rate at which tires were wearing out, and tire requirements.

A report was made of sawmills closed permanently and destroyed by fire in the fir region between January 1 and April 30, 1945. Total 8-hour capacity of these sawmills was 1,620,000 board feet, or 4.6 percent of the aggregate 8-hour capacity of active sawmills in the fir region in 1943.

FOREST UTILIZATION SERVICE UNIT

For the major portion of the year, or until September when E. E. Matson was transferred to this Station, E. G. Locke was the only member of the Forest Utilization Service Unit. With the addition of Matson, it was possible to increase the effectiveness of this unit with a man available for the field of lumber manufacture and markets.

During this year, considerable time was spent in becoming acquainted with the wood-using industries and research institutions dealing with wood utilization. In order to have a permanent record of all wood-using industries in the Pacific Northwest, a detailed file of each industry was started.

The two major projects during 1945 were the development of the two local alcohol plants--the sulphite waste liquor plant at Bellingham, Washington, and the wood hydrolysis plant at Springfield, Oregon--which will use sawmill waste as its raw material. Locke accompanied E. E. Harris of the Forest Products Laboratory on a two-weeks' trip through the Northwest studying primarily the Bellingham alcohol plant, the Springfield alcohol plant, and sources and types of waste available for chemical processing.

Locke has continued to act as technical advisor to the Oregon Forest Products Laboratory located on the campus at Oregon State College at Corvallis, Oregon, and assisted in the correlation of the work of this research group with that of the Forest Products Laboratory. He continued

his work with them on the production of charcoal from sawmill waste and prepared an article for publication in The Timberman giving the results of the operation of this pilot plant. The manufacture of charcoal is one of the most important projects in the Pacific Northwest. This is a low-cost, high-quality fuel needed by the electrochemical and electrometallurgical industries which have located in the Pacific Northwest or which may locate here because of the availability of low-cost Bonneville power. Many conferences were held and finally a meeting was held at the Station which drew together those persons interested in manufacture and use of charcoal. As a result (1) a market survey for charcoal in the Pacific Northwest is under way, (2) the freight rates on charcoal are being investigated, (3) promising methods for producing charcoal from wood waste, both logging and sawmill waste, are being developed, and (4) data are being collected on waste wood supplies suitable for charcoal manufacture.

Assistance was given in setting up two cooperative projects with the Bonneville Power Administration. The first of these dealt with a report to be prepared by Arthur J. Norton, consulting chemist, dealing with the possibility of manufacturing dissolving pulp and its use in the manufacture of synthetic fibers and plastics. The other project was an energy survey of the Pacific Northwest. This latter is of interest to us because hogged wood has been the major industrial fuel of the region.

Staff members assisted Luxford, of the Forest Products Laboratory, in a study of the utilization of low-grade and short-length material through development of basic information to guide design of glued laminated structural members. The local part of the study conducted at the Portland plant of Timber Structures consisted of measurement of slope of grain of clear material and recording knot size and placement in common grade of assemblies for laminating. The assemblies were bundled and shipped to the Speedwall plant of Timber Structures at Seattle for gluing and thence to Madison for structural tests.

The Forest Products Laboratory was assisted in a preliminary survey of second-growth Douglas-fir stands and mills operating on this class of timber. This information is to be used in formulating a plan for a proposed study of the characteristics of second-growth fir so as to determine the best manufacturing practices.

There is an urgent need for increased production of transmission and telephone poles, particularly for the small sizes required for REA lines. The Forest Service has for some time recommended lodgepole pine as an added supply source. Since this type of pole has not been cut in Oregon and Washington, little is known as to the potential volume by length and size classes. The Station in cooperation with the Region started a survey in one of the more likely lodgepole pine areas in Oregon.

A plan was prepared and the Life Magazine photographer and party were accompanied on approximately a 10-day trip through logging and wood processing plants in Washington and Oregon. A series of pictures were

taken and data collected on production, utilization, and waste of the timber resources, which will be used in a story on world forests.

The box industry in the apple-producing area of central Washington is faced with an inadequate supply of pine for the manufacture of boxes. A preliminary investigation was made to determine the feasibility of utilizing other local softwoods.

Tabulations were prepared showing timber volumes and annual lumber production by large and small mills in the Portland area for the Portland Chamber of Commerce. These data are to be used in a study now being made by the Chamber of Commerce to determine the possibility of establishing a large concentration yard and loading dock in Portland where lumber could be dried, surfaced, stored, and prepared for shipment.

From June 11 until November 11, Locke was on detail to the Foreign Economic Administration to investigate methods being used in Germany for chemical utilization of wood. The three major items in Germany which were thoroughly investigated were the Scholler plants, the six plants built for producing a feeding yeast from waste sulphite liquor, and the two Reichert charcoal plants.

The Western Pine Association pilot plant for the solvent-seasoning of lumber was visited and the progress being made at this pilot plant was followed throughout the year. Approximately one month more is required on the study of ponderosa pine and an additional year will be needed to make studies on sugar pine and Idaho white pine. The Vulcan Copper and Supply Co. is analyzing the data collected in this pilot plant.

A large amount of time was spent by the personnel of the Utilization Service Unit in answering miscellaneous correspondence and personal inquiries of individuals interested in the utilization of our forest resources. Several talks were given in various cities in the Region on wood utilization.

Assistance was given the Reappraisal Project in setting up the study on sawmill waste wood supplies.

Locke accompanied Winslow, Stamm, and Truax from the Laboratory on a two-weeks' trip in the Pacific Northwest.

FOREST MANAGEMENT RESEARCH

Douglas-Fir Silviculture

The phase of this broad problem which has received principal attention, almost to the exclusion of all other phases, is the decay in hemlock and Sitka spruce resulting from scars caused by selective logging. This study was made in cooperation with the Office of Forest Pathology,

BPI, and is a continuation of a study initiated in 1943. Seven areas, which had been selectively cut from 10 to 30 years before, were studied. Decay in the many logging scars was the rule and its progress in many cases was rapid. Sunscald was also found to be a flagrant cause of decay in the reserved trees.

Ponderosa Pine Silviculture

Only a little maintenance work was done on this project and no new work undertaken. A number of examinations of permanent plots and of the big Malheur mortality strip that should have been made this year had to be deferred because of lack of personnel. The manuscript "Calculating the Growth of Ponderosa Pine Forests," mentioned under "Mensuration," is of course a contribution to this project as well.

Mensuration

With a much shrunken personnel, a major share of the facilities of forest management were directed this year to the maintenance of the mensurational program. The large series of permanent growth plots in fir, spruce-hemlock, and pine have been a most useful source of knowledge of silvics, growth, and treatment of immature stands.

This year an unusually large number of these plots were due or overdue a remeasurement. Hence, 24 growth plots and 10 thinning plots and their checks in the Douglas-fir region and 5 thinning plots and their checks in the ponderosa pine region were remeasured with the help of CPS assignees. Office work in connection therewith is practically completed.

One set of these growth plots was established in 1910 and its history so written, a chapter each five years, is becoming progressively more valuable and significant. The thinned plots in general demonstrate the stimulus to growth which the release gives, but it is apparent that a large number of plots must be observed for a considerable number of years before the effects of various degrees of thinning, both favorable and unfavorable, can be stated with assurance. Current observational work was also done on some pruning plots.

A set of thinning plots in a ponderosa pine small-poles stand demonstrates the ability of this species to persist in overcrowded stands with great stagnation in growth and yet respond slowly to release by thinnings from below. In a 20-year-old plantation with six kinds of spacing from 4 x 4 feet to 12 x 12 feet, a series of 16 plots was established this year. The results, which have now been issued, show a nice progression in average diameter, average height, length of crown, and size of limbs with increase in the spacing. A major achievement in this field was the preparation by Briegleb, and the revision and editing by Munger, of a long manuscript which will soon be issued entitled "Calculating the Growth of Ponderosa Pine Forests." It assembles all existing knowledge on the topic which the title suggests, but should be considered a progress report,

for much remains to be learned on this subject, particularly under heavy selection cutting silviculture.

Artificial Regeneration

In this field, the work has been largely of a service nature and the amount of that has been considerable. It consists in answering technical inquiries, participating in conferences on reforestation, collecting seed for cooperators and correspondents, reviewing manuscripts, and disseminating the results of past experience.

The arboretum has been maintained at Wind River, but no new experimental work undertaken in this field. There is, however, a great deal of need for further study of nursery practices, especially with certain secondary species, for tests of direct seeding, and for research to improve the technique of field planting in both the fir and pine regions. The Tillamook Burn is a gigantic reforestation problem which demands specialized study.

Fire Studies

Fire studies plans had placed the problems of logging slash hazard highest in priority and more work was done on that topic than on any other during the year. Fire weather rating problems came next in the amount of attention received. Fire control planning on private protection areas, fire behavior, and the use of various mechanical devices in fire control were also studied.

The investigations of slash hazard problems were expanded with the addition in May of a second man, Harold Rapraeger, to the fire studies project. This work was financed by allotments from State and Private Forestry and National Forest Administration, so that critical administrative problems confronting those organizations could be investigated immediately. The hazard in partial cutting operations in the Douglas-fir type was studied extensively in many localities and then a detailed study was made in one locality. From these studies a rating scheme was devised by which the total danger on any given area can be given a numerical value based on the fuel hazard, inception risk, climate, and fire detection and suppression facilities. A start has been made in acquainting the field men with the use of the procedure.

Detailed fire behavior studies were continued on wild fires as opportunity permitted and observations were made on the Tillamook fire during several different periods of its spread. Behavior of broadcast slash burning fires in the Douglas-fir type was studied in a similar manner on several areas and the observations will be useful in piecing together knowledge of good slash disposal procedures as well as knowledge of slash fire behavior and dangers.

Fire weather and fire danger rating records for each of more than 500 stations on all ranger districts in the Region were analyzed for a 4-year

period and tabular data were furnished to each national forest to assist them in fire control planning. A similar study was later made for only 70 stations to compare the 1945 season with the previous 4 years. Fuel moisture records were studied to determine whether monthly average and monthly minimum fuel moistures at different stations occur consistently year after year in similarly related zones of moisture values. The results showed little consistency except for broad differences due to elevation and very broad-scale geographic differences. Several man-months of assistance were obtained from C.P.S. assignees for the several fire weather studies.

Fire danger rating systems were installed at the Fort Lewis military post where about 100,000 acres of forest land are protected and at the Kitsap County, Washington, State and private protection unit. Considerable assistance in fire danger rating application was given to the Regional Forester's office.

In cooperation with the State Forester of Oregon methods of fire control planning were applied to the Eastern Lane County, Oregon, private fire protection unit and a specific plan for improvements was prepared. The plan was accepted and several of its features are already being carried out.

The visibility and detection of small fires from airplanes was briefly investigated on the Chelan National Forest and established principles of smoke visibility were applied to the administrative problems of planning airplane detection. Time studies of snag falling by power saws were initiated and time studies of fire line construction by tractors were continued.

Experimental Forests

Of the five Experimental Forests, two were entirely closed for lack of funds and no work whatsoever done upon them, namely, the Blue Mountain and the Port Orford Cedar Experimental Forests. The Pringle Falls Experimental Forest was opened for about a month and certain maintenance done on going studies. To Wind River and Cascade Head C.P.S. men were assigned to act as caretakers and to do such current maintenance and observation of experiments as they could.

There were no new timber sales and no new construction work on any of these areas.

RANGE RESEARCH

Nine years have now elapsed since range research was initiated at the Pacific Northwest Station.

In 1936 the design of methods of grazing management that would permit the restoration of worth-while natural vegetation on depleted forest ranges

was the single major objective of range research. Emphasis was placed on study of summer ranges, most of which are under national forest control, because shortage of summer range forage was one of the most critical factors threatening the stability of the livestock industry in the region. Depletion of summer range forage as the result of drought and mismanagement had both undermined dependent stock industry and affected the water supply obtained from mountainous watersheds of eastern Oregon and Washington. Restoration of natural vegetation would, consequently, aid in stabilizing livestock production and community welfare.

Marked steps have been made by range research since 1936 in providing information needed in managing the forest range lands. Criteria for judging the condition and trend of subalpine ranges and meadows were determined, and training of administrative officers proceeded apace. Many facts were found regarding utilization of forest ranges and methods of handling cattle on forest ranges. These guides are now in quite common use by administrative men for determining whether past and present grazing practices have been satisfactory.

Additional information useful in the restoration of forest and other ranges will come from the studies of artificial revegetation initiated this year. Such information will speed the program of restoration greatly because on many ranges the original forage cover and soil has been so completely destroyed and the soil altered that artificial reseeding will be needed to secure range restoration within a reasonable period.

Up to the present time, the range research program has been unable to meet fully the needs of forest administration in all fields. We have come to a stage in grazing management where something must be done about ranges in unsatisfactory condition besides the simple expedient of making cuts in stocking. A more constructive approach must supplant or supplement this method of handling grazing problems. No avenue for increasing grazing capacity should remain unexplored before cuts in stocking are decided to be the only recourse.

Before administration can carry out constructive grazing management, range research must provide tested tools. This calls for different types of studies than have been possible up to the present--controlled grazing studies to determine method and intensity of grazing, methods of securing distribution of cattle and sheep on timber range, and detailed studies of plant growth. These studies, which can be conducted most expeditiously at an experimental range, have been impossible to date because funds were unavailable with which to construct physical improvements needed to carry on the grazing studies, and to conduct the studies themselves.

Testing the tools developed by research should be carried out on demonstration allotments jointly by administration and research. Failure to do this is largely responsible for the serious gap between the development of practices and their use in the field. Notable is the fact that only light use has been made of rotation-deferred grazing and one-night bedding

in this Region even though these two practices were developed and advocated on the Wallowa National Forest as early as 1910. It is the joint responsibility of administration and research to carry research results through the "pilot plant" stage.

Two serious problems of forest ranges, now being studied but little, are working against range restoration. The first of these is the grazing load imposed by big game. Facts collected by range research point out the futility of limiting range management to domestic stock where there is a growing big game population. In one area elk increased from 300 to 13,000 head in 20 years, while livestock were being decreased by about 50 percent in order to promote better range conditions. Such an increasing elk herd jeopardizes, in fact nullifies, the efforts being made to bring the range back to satisfactory condition through livestock control and reduction. In many other areas there is a serious problem of overstocking by deer. Big game management cannot be separated from management of domestic stock.

The second of these problems is the loss of range resource because usability is being destroyed by the invasion of trees in grassland and meadows, and the "jungling up" following logging of ponderosa pine range. Large tracts of forest land, once valuable for grazing as well as timber production, become unusable by livestock within 10 to 20 years after logging. This is serious, because it not only means loss of the grazing resource on the area itself but because it forces overstocking and depletion of adjacent range. The administrator, and the permittee, need to know what to expect on ranges being logged over. They need facts regarding the character of sites where loss of grazing values can be expected, how rapidly this change occurs, how to prevent it, and what to do after it has occurred.

The objectives of range research should now be widened to include the solution of problems on other range types. The many problems of the sagebrush-grass juniper, foothill-grass, desert-shrub and semi-desert ranges are fully as important to the livestock industry as those of the forest summer ranges. Relatively little is being done toward their solution.

The problems of the sagebrush-grass type of southeastern Oregon are second only in importance to those of the forest. Intensity of use, system of grazing, character of water developments, eradication of larkspur, methods for sagebrush eradication and reseeding are but a few of the problems in need of solution. Much of the information needed for sheep management may be adapted from that being derived at the U. S. Sheep Experiment Station. It is primarily with cattle management on this type range that additional research is needed.

Problems of the sagebrush-grass range are increasingly important because they may also aggravate directly or indirectly the problems on forest ranges. One of the most notable examples of the relationship between forest and adjacent ranges is that between the forest and sagebrush spring-fall ranges. Lack of stock water and replacement of perennial bunchgrasses by cheatgrass on the spring-fall ranges results in an earlier

demand for summer range. Moreover, in many cases the sagebrush ranges, if restored to their potential grazing capacity, could carry part of the load now imposed on the forest. Actually, to know what should and can be done on the forest ranges without seriously disrupting the livestock industry requires study of the problems of other ranges.

We are also confronted with the problem of grazing cut-over lands west of the Cascades. Here, agricultural interests have promoted the conversion of cut-over and second-growth lands to pasture. In the main, these lands are privately owned. The question is: Is conversion of these lands ecologically, economically, and socially sound? No effort appropriate to the urgency of the situation is being made to provide sound measuring sticks for the determination of what lands may and what may not be successfully used for grazing. The present procedure involves a change in forest types to range by a cut-and-try method which results in needless waste in human energy and natural resources.

To these problems outside the forest boundaries range research at the Pacific Northwest Station must extend its attention if it is to discharge its obligation as range research agency.

During the coming year a major effort is to be devoted to a problem analysis of range problems of Oregon and Washington. This analysis will guide future programs toward the most important range problems facing the livestock industry of these two States. In addition, during the coming year it is planned to develop detailed plans for the Starkey Experimental Range and initiate the studies as rapidly as facilities and funds permit. It is expected also to expand the range reseeding research program, survey the problem of loss of the range resource following logging, continue tracing criteria of trend and condition of ponderosa pine-grass range, explore the possibility of setting up demonstration allotments, and become more closely acquainted with the range problems of Washington.

For the future the study of cattle management on ponderosa pine-grass range and the effect of logging on the grazing resource should be strengthened. Research on grazing management of sagebrush spring-fall ranges, relationship of livestock and big game on forest ranges, grazing cut-over lands of the west side, and grazing management of sheep on forest ranges should be started.

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